THE

HISTOLOGY

OF THE

SUPRA-RENAL CAPSULES.

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THE HISTOLOGY OF THE SUPRA-RENAL CAPSULES.

At the present moment, when the connexion between disease of the supra-renal capsules and bronzed skin is attracting so much attention, I think one need scarcely apologise for bringing under the notice of the profession a contribution to their histology.

Within the last few months several physiologists have attempted to discover the function of the supra-renal capsules, and the relation which might exist between them and the chromatogenous function of the skin, by direct experiment, but without success. The results of my own experiments,* as well as of those that have been published by other observers,† have convinced me that the problem is one more likely to be solved in the dead-house than in the physiological laboratory; and if such be in reality the case, a thorough knowledge of the healthy organs, both as regards their appearance to the naked eye and under the microscope, becomes of primary importance. So little attention has been hitherto bestowed upon the supra-renal capsules, either in the dissecting-room or at post-mortem examinations, that it is much to be feared that occasionally healthy organs are mistaken for diseased, while others but slightly affected are passed by as healthy. Any remarks, therefore, that may tend to remedy this evil can scarcely be looked upon as unimportant.

* British and Foreign Quarterly Review, January and February, 1858.

† Brown-Séquard, Philipeaux, Gratiolet, Vulpain, Martin-Magron, and Virchow.

Supra-renal capsules are found in the bodies of all vertebrated animals. They are developed simultaneously with, but independently of, the kidneys. In the human fœtus at the second month, both organs are of equal volume. From the third month onwards an increasing difference is observed in their relative size.* It has generally been believed that after birth the supra-renal capsules diminish in proportionate bulk and activity of function with advancing years, and consequently they have been denominated fœtal organs. This opinion, however, is now losing ground, since it has been found that they do not become atrophied after birth, and that their growth is not so much even as arrested. In some animals they continue of the same relative size as the kidneys throughout life. In the cat I found that they increased in a greater ratio than the latter organs. In man, however, although they go on increasing in volume after birth, it would appear from the observations of Meckel that the ratio is much smaller than in the case of the kidneys; but it can scarcely be said that even in old age they become proportionally more atrophied than other organs. From these facts we may conclude that the supra-renal capsules have a certain function to perform in adult as well as in fœtal life.

The supra-renal capsules are usually two in number; occasionally, however, supernumerary ones are met with. Very recently I found four in a sheep. The supernumerary were considerably less than half the size of the normal capsules. It has been also mentioned by several authors that they are sometimes altogether absent. Their presence or absence being quite independent of the presence or absence of the kidneys, they would seem to have no direct connexion with the latter organs, for they do not even follow the displacement of them. In brainless monsters they are generally found deficient (Frey).

In the human subject they have a triangular form, which has been very pertinently compared to a cocked-hat.† They are sometimes, however, of an oblong form, or even flattened, and

* Vide Kolliker, Frey, Leydig, &c.

† The left is more triangular in shape than the right capsule; the latter being often crescent-shaped.

spread over the upper and anterior surface of the kidney, like a piece of paper. Dr. Ogle showed a good specimen of the latter kind at a recent meeting of the Pathological Society. Their shape is very various in different species of animals. In some they are almost quite circular, as in the rat; in others they are very much elongated, as in snakes; occasionally they are lobular, and resemble a compressed bunch of grapes, as is seen in the case of the frog.

In man the upper margin of the supra-renal capsule is convex, and about one-eighth of an inch in thickness; the lower margin is concave, and usually about a quarter of an inch thick. The left is generally narrower at its base, longer from above downwards, and larger, than the right. They are on an average about two inches by one in diameter, and, according to Huschke, weigh from 80 to 180 grains. By comparing the relative size of the human supra-renal capsules, as given by Huschke, and of the kidneys by Clendinning,* I find that the weight of the former is to that of the latter as 1 to 18, which I think is much nearer the truth than that given by Meckel—namely, 1 to 28. The relative size of the capsules and kidneys varies very much in different animals. In the common guinea-pig, Frey† gives it as only 1 to 4; while in the seal, Cuvier‡ found it to be no less than 1 to 150.§

Externally the supra-renal capsules have a dirty-yellowish colour, not unlike that of powdered scammony. When cut into, they are seen to be composed of two different coloured portions. The central portion, which constitutes about one-third of the whole thickness of the organ, is of a dark-reddish hue when full of blood; when washed and freed from the latter, of a pale slate colour. In the centre of this, the medullary substance, are several round or oval openings—the mouths of venous sinuses. The cavity, which some authors have described as existing in them, is produced by rupture of the

* Quain's Anatomy, edited by Sharpey and Ellis, p. 316.

† Cyclopædia of Anatomy and Physiology, Part xxxvii. ‡ Ibid.

§ In a specimen kindly sent me from Dublin by Dr. Macdonnell, the relation was as 1 to 189. In the adult mole I find the capsules are to the kidneys as 1 to 44.

tissue between the sinuses, either accidentally during the examination, or as the effect of disease. The medullary substance is bounded on either side by a margin of yellow substance, the internal border of which is of a pale straw, the external of an orange, colour. This, the cortical substance, has a somewhat fibrous appearance, and, although less firm to the touch than the internal medullary part, can scarcely be called friable. (These remarks, of course, only apply to quite fresh and perfectly healthy human capsules.)

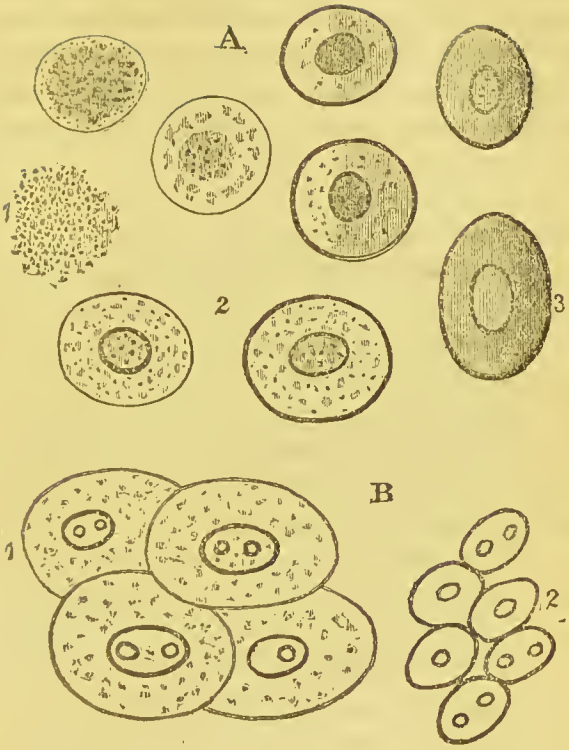
When a transverse section of the supra-renal capsule is examined with a pocket-lens, the medullary substance appears of a somewhat bluish colour, becoming tinged with red as it approaches the cortical portion. In the centre, several openings which were not before visible, come into view. The cortical substance, on the other hand, still retains its yellow hue; but, in addition, is seen to be streaked perpendicularly with red lines; an appearance due, as I shall afterwards have occasion to show, to bloodvessels. The fibrous nature of the cortical substance is readily recognised with the lens.

Microscopical Appearances.

Until within a few years ago, our knowledge of the minute structure of the supra-renal capsules was entirely derived from the results obtained by a microscopical examination of their juice and *débris*. In consequence of this limited method of investigation, the real arrangement of their tissues remained long unknown. And it was not until within a recent date that an observer (Ecker), more zealous than his predecessors, by examining thin sections, discovered that they possessed a minute structure scarcely excelled in beauty by any other organ of the body.

Before describing the appearance of their tissues, I shall first allude to the microscopical characters of their juice. For notwithstanding that the examination of the latter yields no clue to the arrangement of the component parts of the supra-renal body, it nevertheless affords us some interesting information.

FIG. .



From the supra-renal capsule of the frog.—A. 1, Granules; 2, nucleated cells; 3, blood corpuscles. B, 1, Large nucleated cells; 2, free nuclei.

On placing a drop of the expressed juice in the field of the microscope, it is seen to contain an immense number of round bodies of every imaginable size, between that of a large oil globule and the minutest visible speck. At first sight the appearance reminds one of that presented by a drop of new milk. On attentive examination, the smaller of the granules are observed to be in active movement; repelling and attracting each other in rapid succession. Amongst these molecules are seen ordinary oil globules and blood corpuscles. But besides these are a number of round pale-coloured cells, with granular contents. They look not unlike lymph corpuscles, but are

somewhat smaller. They average, in the human subject, $\frac{1}{100}$ mm. ($\frac{1}{2500}$ inch) in diameter. In the juice of the supra-renal capsule are also found nucleated cells, filled with molecular particles. These cells occasionally, although not often, contain two nuclei. Besides these, there are nuclei that appear to be surrounded by molecular particles unenclosed in a cell-wall; and others where indistinct marks of a cell-wall are visible; which leads one to suppose that the cell-wall is either in the course of formation, or has been partly destroyed. The fully-developed nucleated cells, as well as the aggregation of granules round nuclei, measure about $\frac{1}{40}$ mm. ($\frac{1}{1000}$ inch) in diameter. In some the granules are pale; in others, very dark coloured. The cells, which were previously spoken of as resembling small lymph corpuscles, may possibly be nothing more than free nuclei.

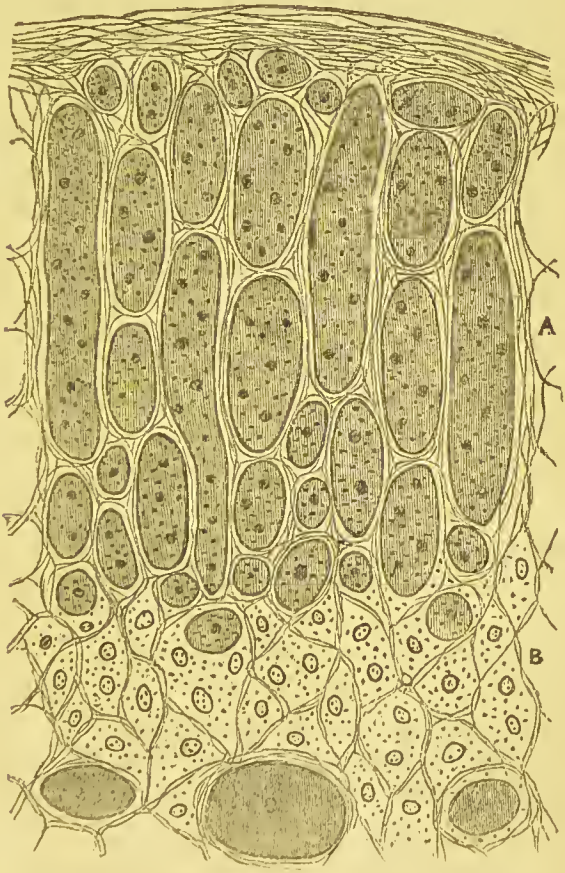
Mr. Gulliver mentioned having found, in many of the ruminants, "the minute molecules less plentiful, their place being supplied by corpuscles somewhat resembling lymph globules in size, but often of a reddish colour, and occasionally of an oval figure."* The small granules and active molecules are particularly abundant in the supra-renal capsule of the rat. The peculiarity of these molecules is that they undergo, as pointed out by Gulliver, no change, when treated with acids or alkalies, until after a considerable lapse of time.

In order to study the structural arrangement of the component parts of the supra-renal capsules, very thin sections of the organs must be examined. Although healthy and perfectly fresh supra-renal capsules admit of being cut into thin slices with the knife, yet it rarely happens that the sections are sufficiently delicate to allow of their structure being well seen. On operating on fresh capsules, I usually obtain the best sections by cutting them with a razor under water. But by far the best method is to harden the capsule with chromic acid, and afterwards render the section transparent with glycerine. Those who have had to contend with the difficulties attending the microscopical examination of supra-renal capsules, will scarcely, I think, regard these remarks as superfluous.

* Gerber's General Anatomy, translated by Gulliver, Appendix, p. 104.

When a transverse section of the human supra-renal capsule is examined with a low power of about eighty diameters, the cortical substance is seen to be composed of numerous cells, arranged in somewhat irregularly-sized rows; the rows of cells appear like a number of dark-yellow columns, placed perpendicularly to the surface. (Fig. 2, A.) The columns terminate

FIG. 2.



Transverse section of a human supra-renal capsule.—A, Cortical. B, Medullary substance. C C, Sinuses.

somewhat abruptly at the margin of the medullary substance. (B.) The latter, when viewed with a low power, such as that

just mentioned, presents no definite structure. Running along the centre of the medullary substance is a line of round or oval openings of various sizes, the mouths of the sinuses. (C C.)

If the cortical substance be examined with a high power of about 400 diameters, the cells constituting the rows will be found to resemble in size and general appearance those lining the tubuli uriniferi of the kidney. They differ from the latter very strikingly, however, in their peculiar colour. Each individual cell in the human subject has an average diameter of about $\frac{1}{50}$ mm. ($\frac{1}{1250}$ inch.) Their size varies but slightly. The minimum diameter being about $\frac{1}{70}$ mm. ($\frac{1}{1750}$ inch), the maximum, $\frac{1}{40}$ mm. ($\frac{1}{1000}$ inch.) They consist of a cell wall, granules, pigment, a nucleus, and a greater or less quantity of oil globules. Some authors speak of their peculiar yellow colour being dependent upon the amount of fat globules they contain. I think, however, that the fat globules only contribute to the colour. When floating free in the field of the microscope, the cells appear to be irregularly round; but when grouped together, they have a polygonal shape. Each cell possesses a nucleus, although it is not always visible without the employment of reagents.

The simplest and most beautiful mode of demonstrating the existence of a nucleus, is by colouring the cells with carmine. As this process of imbibition, as it is called, is quite new in England, indeed in any country, it being scarcely a year since it was employed for the first time in Germany,* I may briefly describe it.

"Imbibition" might be termed a process of natural injection. The principle upon which it is founded exists in the fact, that different animal tissues absorb and retain pigments with various degrees of avidity. Thus, for example, while granular tissues possess a special attraction for colouring matters, homogeneous substances display but a feeble affinity for them. And in the tissue composed of aggregated cells, different parts are

* As far as I am aware, Gerlach and Welcker were the first to employ it.—P.S. Since writing the above, I find that, in 1778, Gleichen describes a process of colouring infusoria by carmine.

coloured in various degrees of intensity. Thus the homogeneous cell wall retains its colourless appearance long after its molecular contents have become deeply tinged, and the nucleus, which is usually the most granular part, has assumed a prominent dark hue.

The process of "imbibition" is very simple. A small quantity of pure carmine is dissolved in liquor ammonia. The solution is diluted with water, and thin sections, ready for microscopic examination, are kept in it during twenty-four or forty-eight hours. At the end of this time, the substance will be found thoroughly dyed and fit for use. I may remark, that attention must be paid to avoid having any gritty particles in the colouring solution. I would therefore recommend it to be filtered before the tissues are added. The carmine solution unfortunately putrefies very rapidly, but I find this is easily prevented by adding a few drops of alcohol, which does not impair its efficacy, unless in excess.

On examining some coloured preparations of the brain and spinal cord kindly presented to me by Professors Gerlach and Welcker, I was struck, as everyone must be who examines them, with the remarkable distinctness of the nuclei of the ganglion corpuscles. Thinking that the affinity for colouring matters might be especially characteristic of ganglion cells, and being at the time very anxious to discover a test by which these might be distinguished from the large caudate corpuscles occurring in the medullary substance of the supra-renal body, I tried the process of imbibition on a variety of tissues, and soon found that all cells with equally granular contents became tinged in a similar degree. While investigating this point, I was fortunate enough to find the process of imbibition a valuable aid in the examination of the supra-renal bodies. Through its means, it could be shown that all the cells in the cortical columns possessed a large nucleus. The nucleus appeared so very distinct in cells where before the colouring matter was employed not a trace of one could be detected, that I at first thought that the nucleus did not perhaps pre-exist in all the

cells, but was merely the result of the treatment, the ammoniacal solution of carmine having caused the granules distributed throughout the cell to become aggregated together, and thus give rise to the appearance of a nucleus. On examining the cells attentively, however, I was able to satisfy myself that such an explanation was incorrect. The cell still retained its granular appearance, irrespective of the nucleus. While the cell, as I said before, has an average diameter of about $\frac{1}{50}$ mm. ($\frac{1}{1250}$ inch), the nucleus is of considerable size, measuring, on an average, $\frac{1}{133}$ mm. ($\frac{1}{3325}$ inch) in diameter. The nuclei are generally round and granular.

Arrangement of the Cells in the Cortical Substance.

Considerable difference of opinion exists amongst histologists as to the manner in which the cells are arranged. Mr. Simon thinks that the columnar masses which they form are a series of closed tubes lying perpendicular to the surface of the organ; while Kölliker, Frey, Ecker, and most other observers, describe the cells as being grouped together in a number of oblong vesicles, lying in parallel rows, but having no communication with each other. Mr. Gray, on the other hand, believes that the adjoining walls of the vesicles are sometimes removed by absorption, and thus give rise to tubular cavities. My own opinion regarding the arrangement of the cells may be given in a very few words, as it will be more readily understood by a glance at the woodcuts than by pages of explanation.

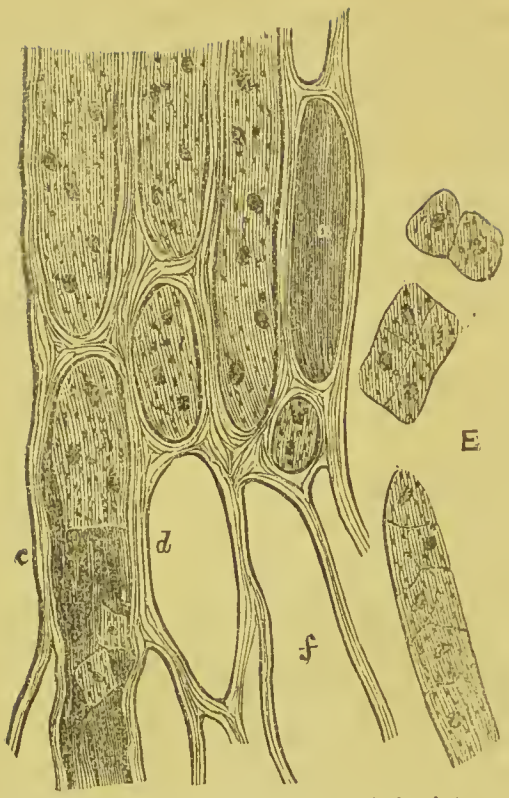
It appears to me that the contrary descriptions given by different histologists are more the result of a variety in language than a difference of opinion. To the same structures the name tubes, sacculi, and vesicles have been applied. This variety of interpretation is easily accounted for. For even in the same section the cells may be seen arranged in the form of tubes, of sacculi, and of round vesicles. Fig. 2 represents somewhat roughly this state of things.

In a good section the cells are seen to have a definite arrange-

ment. They are grouped together, as represented in Fig. 2, in a number of larger and smaller masses. These lie in parallel rows, and give rise to a columnar appearance. Some of the cell-masses are small, and round, not greater than the diameter of a single cell. These are chiefly found at the external and internal extremities of the columns. Others of them are oval, like vesicles, and some are oblong, not at all unlike blind sacculi. On the other hand, occasionally a cell-mass is found to extend almost throughout the whole thickness of the cortical substance, and to have very much the appearance of a tube with closed ends. Notwithstanding that the cell-masses vary so much in length, their breadth remains tolerably uniform, the diameter of the smallest being about $\frac{1}{60}$ mm., ($\frac{1}{1000}$ inch,) and of the thickest about $\frac{1}{20}$ mm., ($\frac{1}{500}$ inch.) Each cell-mass, as well as each column is separated from the rest by intervening fibrous tissue. This is represented in Fig. 3. The fibrous tissue surrounding the mass of cells is most distinctly seen when the cells have chanced to fall out, as frequently happens in thin sections. (Fig. 3, *d*, *e*.) On tracing the fibres they are seen to arise from prolongations of the investing fibrous capsule of the organ.

As was already mentioned, the cell-mass may take on the appearance of a tube. In good sections of the human suprarenal capsule it is not uncommon to meet with a single straight row of cells extending throughout the whole breadth of the cortical substance, and it is difficult to divest oneself of the idea that it is a tube. This appearance is represented in Fig. 4. In the specimen from which the figure D was copied, there were two single rows of cells lying parallel to each other. The cells were of a quadrilateral form, and the whole structure reminded me forcibly of two rows of bricks. In the case in question, the intervening space between the rows was about half the breadth of the cells, and it looked exactly like the cavity of a tube bounded on either side by a row of epithelium cells, such as is seen in the tubuli uriniferi of the kidney. (See Fig. 4.)

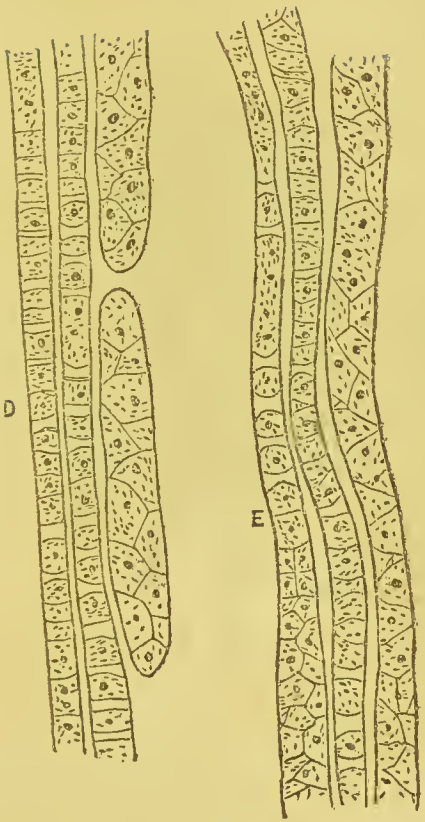
Fig. 3.



Portion of a transverse section of the cortical substance of a human supra-renal capsule. *a*, Empty loculus, with basement membrane. *d*, The same, without basement membrane. *f*, Fibres. E, Cells fallen out from the loculi in masses.

On one occasion I found a single row of cells extending from the one margin of the cortical substance to the other. It contained upwards of thirty cells. It not unfrequently happens that one meets with a column, partly containing a single, and partly a double, row of cells. Such an one is represented in Fig. 4, E. The walls enclosing the single and the double row of cells are perfectly continuous with each other, showing that the appearance is not due to the accidental union of two cell-masses. Indeed, I have never met with any appearance which would lead me to believe that one cell-mass communicated with

Fig. 4.

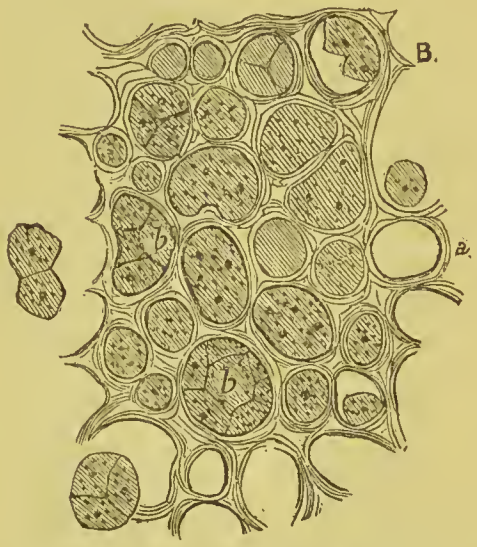


Columnar cell-masses having the appearance of tubes from the human capsule.

another, either directly or by a duct. It sometimes happens that the cells in the single rows are not closely packed together, but are separated by irregularly-sized intervals. This appearance may, however, be due to the process of preparation, as I have not seen it in sections of the fresh capsules. In order to ascertain if the columnar cell-masses, having a close resemblance to tubes, were not actually what they looked like, I made sections of the cortical substance at right angles to the direction of the columns. These transverse sections are very

characteristic. The ends of the columnar cell-masses appear as round or oval spaces filled with cells, as seen in Fig. 5. The

Fig. 5.



Section across the columnar cell-masses. *a*, Empty loculi. *b*, Loculi completely filled with cells, and having no central opening.

oval or round spaces containing the cells measure from $\frac{1}{40}$ to $\frac{1}{15}$ mm. ($\frac{1}{1000}$ to $\frac{1}{625}$ inch) in diameter; they usually contain from one to five cells. They are in some parts very closely packed together; at others loosely scattered about, leaving interlocular spaces of various sizes and shapes. Sometimes in thin sections the cells have fallen out, and left empty cavities. (Fig. 5, *a*.) At other times they have only in part fallen out, and those remaining are seen partially detached from the walls of the cavity. In uninjured specimens it is easily seen that the cells completely fill the entire loculi, be they small or be they great, which, it will be remembered, is a very different state of things from what is found in true tubes. When, for example, a transverse section of the tubuli uriniferi is examined, the ends of the tubes are not found to vary greatly in diameter in the same part of the organ. They are never so small as to

contain but one cell, as in the case of the supra-renal capsules, neither are they ever completely filled with cells. There is invariably a free space in the interior of each tube, and around this central cavity are arranged the epithelial cells. Further, the cells are only one row deep, and regularly ranged in a circle upon the membrana propria. As the columns of the cortical substance of the supra-renal capsules, when seen in transverse section, present none of these characters, I do not think that they deserve the name of tubes. (See Fig. 5.)

In describing the cavities containing the cell-masses, Kölliker speaks of them as mere loculi in the stroma of the organ, possessing no limitary membrane. With all due deference to the opinion of my former teacher, which I have much cause highly to appreciate, I must acknowledge that I think Ecker and Frey are correct in stating that the loculi are lined with a homogeneous membrane. I have been able to demonstrate it in the longitudinal section of the cortical substance by carefully washing away the cells. The basement membrane, althongh exceedingly delicate, is, however, distinctly visible, especially at those points where, when accidentally torn, it is thrown into folds. After the preparation has been kept during some weeks in glycerine, the membrane, which at first appeared homogeneous, becomes granular. The basement membrane is represented as lining the loculi in Fig. 3, *a* and *c*, which contrasts strongly with some of the other loculi from which the membrane has been removed in making the section, and which appear as empty holes. This condition is seen at *d* in Fig. 3.

The cells sometimes fall out of the loculi all in a mass, and they then appear as if they were held together by an invisible investing substance. There is no special connecting substance, however, for they are readily separated by the needles. (Fig. 3, E.)

Medullary Substance of the Supra-renal Capsules.

The dark, slate-coloured, medullary substance, when examined with the microscope, is seen to possess a very different structural arrangement from that of the cortical portion of the

organ. When viewed with transmitted light, it looks much paler in colour than the latter, and is quite free from any columnar cell-masses. The numerous openings of its sinuses give to it a very characteristic appearance. With a low magnifying power, no very definite idea of the arrangement of its component parts can be obtained. It looks merely like a uniform mass of cells, bounded on either side by the cortical columns. With a high power of about 400 diameters, it is seen to be composed of a reticulated fibrous structure, in the meshes of which lie a number of large, pale-coloured cells with round nuclei. The cells measure, on an average, $\frac{1}{40}$ mm. ($\frac{1}{1000}$ inch), the nuclei $\frac{1}{100}$ mm. ($\frac{1}{2500}$ inch), in diameter. Although at first sight these large cells appear to be irregularly distributed throughout the network of fibres, on the close inspection of a favourable specimen they are seen to follow a somewhat symmetrical arrangement, being singly or in small groups, surrounded by fibres. No basement membrane is here visible, nor can the cells be easily detached from the fibres. (Fig. 2, *b*.)

The cells of the medullary substance have been described by Kölliker and Brown-Séquard as resembling ganglion corpuscles; and certainly, when seen lying in clusters amongst the fibres, they have some similarity to them. For example, they have about the same diameter, they have a well-marked nucleus, and they appear in some cases caudate. When seen singly, however, they look much more like secreting cells. I have never seen a detached one have a caudate appearance, and I am inclined to believe it is the peculiar arrangement of the reticulated fibres which gives the cells that appearance. In the sheep, these ganglion-corpuscle-shaped cells are remarkably plain. Some have two nuclei, and also nucleoli. Both the nuclei and the cells are filled with granular contents. This is best seen in the coloured specimens. Ecker, in describing the medullary substance, speaks of the nuclei as being surrounded by granular matter, but omits all mention of a distinct cell-wall.*

* Ecker on the Supra-Renal Capsules. Translation in the *Medical Gazette*, 1848.

While examining fresh human supra-renal capsules, I frequently scratched out some of the nuclei from the reticulated fibres, and they had in most cases exactly the appearance spoken of by Ecker. The nucleus lay in the midst of granular flocculi, without any vestige of an enclosing envelope. When the meshes of the fibres were slowly torn across, however, the margin of the granular flocculi in some cases was so distinct, that one could scarcely doubt the existence of a cell-wall. This point requires further investigation. The general appearance of the medullary fibres is given in fig. 2, *b*.

Virchow mentions having seen true ganglion corpuscles in the human capsules; but adds that he does not look upon them as composing the medullary substance of the organ, but merely attached to the nerves.* In describing the supra-renal capsules of the land salamander, Leydig states that one part of them is almost entirely composed of dirty-yellow ganglion corpuscles; and that these, through a gradual change in their contents, go directly over into the fatty granular cells proper to the supra-renal body.

Vessels.—The supra-renal capsules are very freely supplied by bloodvessels. Nagel,† who described the arrangement of them very minutely, says that the greatest part of the capsules consist of capillaries, and that there are two sets of blood-vessels very differently distributed. One set pierce the fibrous sheath of the organ and penetrate directly into its substance, where part of them immediately divide themselves into a capillary network, which surrounds the columnar cell masses. Another portion pass through the cortical substance, and divide into branches in the medullary part. Some of these latter branches here form a capillary network, while others return to the cortical substance, and there, amongst the cell-masses, break up into capillaries.

Another portion of the arterial trunks, before entering into the substance of the supra-renal body, to follow the ultimate

* Archiv. f. Pathol. Anat., band xii., heft 4, w. 5, p. 483.
† Müller's Archiv. f. Physiol., 1836, p. 366.

distribution just spoken of, course along for some distance in the fibrous capsule. I have been able to confirm this description, although not entirely. I never saw, for example, any of the branches returning from the medullary portion of the organ break up into capillaries in the cortical substance, which they had already traversed in the form of twigs. My idea of the distribution of the vessels may be given in a very few words. When the arteries arrive in the fibrous capsule of the supra-renal body, they divide into a number of branches, which spread themselves in the fibrous sheath over the organ. These branches penetrate at various points into the cortical substance, in which

Fig. 6.

Transverse section of a human supra-renal capsule, showing the distribution of the bloodvessels. *a*, artery; *b*, veins; *c*, sinuses.

they subdivide into smaller branches. The greater part of the latter form a capillary network amongst the columnar cell-masses. While a few pass onwards into the medullary substance to supply its tissue with blood. The veins resulting from the reunion of the capillaries commence in the cortical part of the organ, and pass on towards the sinuses, into which they empty themselves. The arrangement of the bloodvessels is represented in Fig. 6.

Nerves.—The supra-renal capsules are supplied by almost more nerves than any other organ of the body. Nearly every section placed under the microscope contains some twigs. They run in such irregular order that I have not yet been able to satisfy myself with their true distribution. According to Ecker, however, the bundles of nerves surrounded by cellular tissue, which penetrate the cortical, give off no fibres until they have reached the medullary substance. They then break up into twigs, and form a network of nervous tissue.

Upon histological grounds, Kölliker says that he would regard the function of the cortical and medullary substances as distinct from each other. The former portion of the organ, he thinks, is probably in some way connected with the blood glands; while the latter substance, in consequence of its richness in nerves, and its containing cells resembling ganglion corpuscles, he regards as probably an apparatus connected with the nervous system. Leydig and Bergmann go even further, and say that the supra-renal bodies stand in so close a relationship with the nervous system, that they are entitled to be considered as a part of it. I cannot agree with either of these conclusions; because, although in man and some of the higher mammalia the cortical and medullary substances appear to be made up of perfectly different elements, this is not the case in all. In the horse and in birds, as Frey has pointed out, the whole supra-renal capsule seems to have a tolerably uniform structure, and even in man I have occasionally seen the medullary substance filled to such an extent with the cell-masses proper to the cortical portion, that scarcely any difference

could be detected between the two parts. Moreover, from my observations, chiefly those upon sheep, I am not prepared to admit that the large cells of the medullary substance are ganglion corpuscles; and further, the columnar cell-masses are so closely allied to some of the gland vesicles found in the digestive canal, especially to those of the Peyerian patches, as Frey pointed out, that I incline to the opinion that the function of the former is like that of the latter, secretory. As the aim of this communication is not to attempt an explanation of the function, but merely to describe the structure of the supra-renal capsules, I shall not at present enter more fully into the question.* I shall merely add that in the supra-renal capsules of the frog I have been able to trace the development of blood corpuscles. I have seen, as represented in Fig. 1, first, a collection of granules without any cell-wall, or the slightest appearance of a nucleus, (Fig. 1, A); secondly, a mass of granules surrounded by a delicate envelope; thirdly, a gradual aggregation of the granules in the centre of the cell; fourthly, the increased aggregation of the granules, giving rise to the appearance of a nucleus, (Fig. 1, A, 2); fifthly, a perfectly-formed granular nucleus, and a great decrease of the granular matter throughout the rest of the cell; sixthly, a homogeneous nucleus, and a total absence of granular matter, the cell having at the same time a general yellow hue; seventhly and lastly, a perfectly-formed blood corpuscle. (Fig. 1, A, 3.) Besides, there are a number of much larger cells in the supra-renal capsule of the frog; they are pale, slightly granular, have a very delicate cell-wall, a well-marked nucleus, and occasionally one or two nucleoli. (Fig. 1, B, 1.) Sometimes a cluster of nuclei is observed, which present no appearance of being enclosed in cells. (Fig. 1, B, 2.) This observation tends to support the opinion that the supra-renal capsules serve for the higher organization of the blood.

Somerset-street, Portman-square, May, 1858.

* Vide paper entitled "An Experimental Inquiry into the Function of the Supra-Renal Capsules, and their supposed connexion with Bronzed Skin," in the British and Foreign Quarterly Review for January and April, 1858.